

**REMARKS**

Claim 12 is amended herein to recite a process for producing a photocatalyst comprising a capsule structure which comprises a cadmium compound shell and a void. Support is found, for example, at paragraph 5 on page 9 and paragraph 4 on page 13 of the specification and the original claims. No new matter is presented.

This Amendment is being submitted in response to the Examiner's Answer dated October 2, 2007.

In the Examiner's Answer, the Examiner maintains the obviousness-type double patenting rejection of claims 1 and 3-5 based on co-pending Application No. 10/507,895, the §103 rejections of claims 1-3, 6-8 and 10-18 based on Hirai et al, the §103 rejection of claims 1-8, 12 and 19-23 based on Buhler et al and the objection to claim 9.

**I. Response to Double Patenting Rejection**

Claims 1 and 3-5 remain provisionally rejected under the judicially created doctrine of obviousness-type double patenting as allegedly being unpatentable over claim 1 of co-pending application No. 10/507,895.

Applicants defer responding to the provisional obviousness-type double patenting rejection for the time being.

**II. Response to Claim Rejections under 35 U.S.C. § 103**

**A. Hirai et al**

Claims 1-3, 6-8 and 10-18 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hirai et al (U.S. Patent No. 6,051,614).

(1). With respect to claims 1-3 and 6, in the Examiner's Answer the Examiner acknowledges that Hirai et al teaches a process different from the characteristic process for forming the photocatalyst of the present invention stating that Hirai et al may disclose "a process different from the characteristic process for forming the catalyst of the present invention". See the sentence bridging pages 7-8 of the Examiner's Answer. However, the Examiner maintains that the "non-aqueous dispersion of the metal (compound) particles" obtained from the process of Hirai et al are within the scope of the present claims which do not reflect whether the claimed photocatalyst is in particulate form, in a dispersion, or in an aqueous medium, nor reflect the physical states of the components employed to obtain the claimed photocatalyst.

In response, Applicants submit that it is clear from the present claim language that the photocatalyst is a particle based on the recitation of "having a particle size". Therefore, Applicants disagree with the statement made by the Examiner that the present claims do not reflect whether the claimed photocatalyst is in particulate form. Also, the present claims recite that the photocatalyst has a capsule structure and the capsule structure comprises a cadmium shell and a void, which is not disclosed, taught or suggested by Hirai et al.

(2). The Examiner acknowledges that Hirai et al does not explicitly disclose that the particles themselves have a shell-and-void structure. However, the Examiner takes the position that because the reference teaches the formation of metal sulfide particles employing components comparable to those respectively recited in the instant claims, one of ordinary skill in the art would reasonably expect that the particles of Hirai et al could exhibit a shell-and-void structure.

In response, Applicants respectfully submit that the Examiner is not applying the proper standard. The question is not whether the particles of Hirai et al **could** exhibit a shell-and void structure. The test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art, further in consideration of the general knowledge in the art. There is nothing in the prior art which suggests the desirability to modify or combine disclosures. The Examiner has not identified a capsule structure comprising a cadmium compound shell and a void as being a known option to solve a problem in view of a design need or market pressure, and under these circumstances, the fact that references can be combined or modified is not sufficient to establish *prima facie* obviousness (*KSR International Company*). It is also insufficient to establish *prima facie* obviousness based on the assertion that a modification is within the capabilities of one of ordinary skill in the art without an apparent reason to make the modification. In this case there is no teaching or recognition in the reference of a “shell-and-void structure” and there is no apparent reason for one of ordinary skill in the art to modify the disclosure of the reference to achieve a “shell-and-void structure”.

In this regard, Applicants note that in Hirai et al the formation of metal sulfide particles is only mentioned at column 5, lines 18-24, which relates to “a method for preparing a non-aqueous dispersion of particles”. This disclosure of Hirai et al merely describes that “an aqueous dispersion of fine particles of a metal sulfide such as copper sulfide, cobalt sulfide, nickel sulfide or cadmium sulfide can be obtained by acting as a sulfurizing agent such as sodium thiosulfate, sodium sulfide, ammonium sulfide, hydrogen sulfide or zirconium sulfide with an aqueous solution of a metal salt corresponding to the desired metal species”. Thus, Hirai et al (US ‘614)

in no way teaches the process limitations of present claim 2, let alone the requisite capsule structure. Thus, the Examiner has not made a *prima facie* showing of obviousness.

(3). In response to Applicants' argument that the Examiner has not set forth a reasonable basis for asserting that the prior art reference inherently meets the elements of the present claims, the Examiner states that the references have been applied against the present claims based on obviousness and not inherency.

Applicants respectfully submit that because Hirai et al does not explicitly disclose that the particles themselves have a shell-and-void structure, the Examiner has no choice but to rely on a theory of inherency for arriving at this element of the present claims. To support a position based on inherency, the Examiner would have to provide a reasonable technical basis for asserting that this element of the claims is inherently met. However, the Examiner has not met this initial burden of providing a reasonable technical basis for asserting that this element of the claims is met, taught or suggested.

For reasons of record and the reasons set forth herein, the non-aqueous dispersion of metal compound particles of Hirai et al is not a capsular structure as recited in the present claims. Applicants respectfully submit that the issue is not whether the solution of cadmium salt is aqueous or non-aqueous, but whether the reference teaches a capsular structure having a shell containing a cadmium compound and a void or cavity (between the outer and inner surface of the capsular shell). The fact that Hirai et al discloses a non-aqueous dispersion indicates to one of ordinary skill in the art that a capsule structure is not formed and thus Hirai et al does not teach or suggest a capsule structure. Also, the fact that Hirai et al teaches particles having an average

particle diameter within the recited range also does not indicate that the particles have a capsular structure. Therefore, these features, recited in the present claims, patentably distinguish the claimed product from Hirai et al.

As mentioned above, the Examiner has the initial burden of providing a reasonable technical basis for the assertion that the prior art references meet the requirements of the present claims, explicitly or inherently. "The examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). Since the Examiner has not met this burden, Appellants are not required to provide evidence to show that Hirai et al does not exhibit the claimed capsular structure comprising a cadmium compound shell and a void.

(4). Regarding the arguments with respect to claims 8, 10 and 11 that Hirai et al does not teach or suggest "dropping" a solution of cadmium salt into a solution of a cadmium compound as required by claim 8, the Examiner asserts that teachings of the prior art of "treating" and "contacting" are synonymous with "dropping".

In response, Applicants respectfully submit that the term "dropping" is similar to "treating" from the standpoint of a means for action. "Dropping" is one means of "treating". However, the term "dropping" is different from "contacting" (i.e. contacting particles with a non-aqueous liquid (**not** reacted)). That, is the meaning of "treating" is entirely different from that of "contacting".

Hirai et al does not disclose, teach or suggest “dropping” a solution of a cadmium salt into a solution of a sodium compound as required by present claim 8. The specification at page 18, lines 18-22 discloses that a cadmium salt dropped into a solution of a sodium compound will first form a microscopic solid phase of cadmium hydroxide, etc., and then turn into a cadmium compound instantaneously to form the shells of capsules of the photocatalyst of the present invention. On the other hand, Hirai et al does not teach, suggest or even mention “dropping” a solution of a cadmium salt into a solution of a sodium compound. Also, none of the working examples of Hirai et al employs a solution of a cadmium salt. Thus, for this additional reason, one of ordinary skill in the art would not have been motivated to modify the disclosure of Hirai et al with a reasonable expectation of success.

(5). Regarding the arguments with respect to claims 12-18, the Examiner asserts that from the teaching so Hirai et al at column 4, line 66 to column 5, line 3, one of ordinary skill in the art would select the necessary starting materials to obtain cadmium sulfide.

Applicants respectfully submit that the question is whether the reference suggests the desirability to do so. In this regard, Applicants submit that the Examiner has not made a *prima facie* showing of obviousness. Hirai et al generally teaches, “an aqueous dispersion of particles of a metal sulfide such as copper sulfide, cobalt sulfide, nickel sulfide or cadmium sulfide can be obtained by treating an aqueous solution of a metal salt corresponding to the desired metal species with a sulfide-forming agent such as sodium thiosulfate, sodium sulfide, ammonium sulfide, hydrogen sulfide or zirconium sulfide.” However, claim 12 of the present application requires admixing a solution of a sodium compound in a suspension of particles of a cadmium

compound. Hirai et al teaches an aqueous solution of a metal salt and not a suspension.

Therefore one of ordinary skill in the art would not have been motivated to modify the disclosure of Hirai et al with a reasonable expectation of success.

In view of the above, Applicants respectfully submit that the present invention is patentable over Hirai et al. Withdrawal of the rejection is respectfully requested.

**B. Bühler et al**

Claims 1-8, 12 and 19-23 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Buhler et al (U.S. Patent No. 4,484,992).

The Examiner refers to column 4, lines 38-45 of Bühler et al as teaching a method for producing a catalyst by photocatalytic deposition of the metals on the semiconductor powders. Additionally, the Examiner refers to column 5, lines 47-50 of Bühler et al, as teaching treating semiconductor powders with the vapors of metals, especially treating cadmium sulfide or cadmium sulfoselenide powders with the vapours of platinum. Further, the Examiner refers to Examples 1 and 2 of Bühler et al, which are entitled "Cadmium Sulfide Coated With Platinum". The Examiner considers the coating of cadmium sulfide with platinum to correspond to the present claimed invention.

Claim 12 is amended herein to recite a process for producing a photocatalyst which comprises a capsular structure, comprising a cadmium compound shell and a void and having an average particle diameter of 100 nm or less. Bühler et al does not disclose, teach or suggest these features of the present invention.

As described in Applicants' specification, the shell of the photocatalyst of the invention is of a stratified structure formed by a particle layer of a cadmium compound. Page 11, lines 1-4 of the paragraph bridging pages 11 and 12. Since the shell of the photocatalyst has a stratified structure it has innumerable pores defined by interstices existing among the cadmium particles connected to one another. Page 6, lines 10-15.

The photocatalyst of the present invention having a capsule structure comprising a cadmium sulfide compound shell and void is obtained by a characteristic process of reacting a sulfurizing agent on a cadmium oxide (hydroxide) once prepared, instead of an aqueous solution of a metal salt, thereby promoting a process of dissolution of cadmium oxide (hydroxide)-reaction of cadmium ions and sulfide ions in the sulfurizing agent-shell formation containing cadmium sulfide. See specification, page 16, lines 2-9.

Applicants have previously pointed out that Bühler et al fails to disclose, teach or suggest a capsular structure comprising a cadmium compound shell and a void as recited in claim 1. Bühler et al also fails to disclose, teach or suggest the average particle diameter of the photocatalyst as recited in the present claims. Specifically, Bühler et al discloses a process for effectively supporting co-catalyst on a semiconductor powder. Bühler et al teaches coated semiconductor powders and does not refer to "a catalyst" and "a process for producing a catalyst" as in the present invention. The coated semiconductor powders of Bühler et al comprise a cadmium sulfide/semiconductor powder, which is at least partially coated with a noble metal, e.g., platinum. The semiconductor powder corresponds to a photocatalyst of the present invention. The present invention is directed to a specific photocatalyst itself and a



process for producing the same. Accordingly, the technical concept of Bühler et al is entirely different from that of the present invention.

Additionally, Bühler et al fails to disclose, teach or otherwise suggest a capsular structure comprising a cadmium compound shell and a void as claimed. Moreover, the Examiner has not pointed to any teaching in the art which might indicate that Bühler et al implicitly or inherently teaches a capsule structure comprising a cadmium compound shell and a void as claimed or that would motivate one of ordinary skill to modify the disclosure so as to achieve the claimed capsular structure with a reasonable expectation of success.

Applicants further note that the Examiner has the initial burden of providing a reasonable technical basis for the assertion that the prior art references meet the requirements of the present claims, explicitly or inherently. "The examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) Since the Examiner has not met this burden, Applicants are not required to provide evidence to show that Bühler et al does not exhibit the claimed capsule structure comprising a cadmium compound shell and a void.

In this regard, Applicants note that the Examiner's position that the disclosed cadmium sulfide (upon which a noble metal is deposited) meets the elements of the present claims, is not a reasonable basis for asserting that Bühler et al discloses the claimed capsular structure comprising a cadmium compound shell and a void. This is because Bühler et al does not teach or suggest the characteristic process for obtaining the capsular structure comprising a cadmium

compound shell and void, and because Bühler et al does not disclose, mention or suggest that the cadmium sulfide particles coated with a noble metal have the required capsular structure. In Bühler et al, cadmium sulfide and titanium dioxide, etc., are exemplified as “a semiconductor powder” (see, e.g., column 2, lines 28-30). For, example, in Example 14 of Bühler et al, it is disclosed that Cd element and platinum are supported on CdS. The CdS is simply used as a catalyst (i.e., host) for supporting platinum (and Cd) thereon. Thus, Bühler et al is directed to a totally different technical concept from that of the present invention.

Applicants also note that the photocatalyst of the present invention having a capsular structure as recited in the present claims allows for the use of visible light an inexhaustible source and clean source of natural energy for its photocatalytic activity, is nontoxic and has a long life as compared to a photocatalyst composed of simple particles. See e.g., page 9, paragraphs 3-5. Further, the data provided in the specification sufficiently establishes criticality of the capsular structure of the present invention based upon, for example, a comparison of Example 1 to Comparative Example 3. Buhler et al does not teach suggest or even mention a capsular structure and therefore one of ordinary skill in the art would not have been motivated to modify the disclosure of Buhler et al with a reasonable expectation of success.

In view of the above, the present invention is patentable over Buhler et al. Accordingly, Applicants respectfully request withdrawal of the rejection.

### III. Allowable Subject Matter

Claim 9 is objected to as being dependent on a rejected base claim but would be allowable if rewritten in independent form including all of the elements of the base claim and any intervening claims.


Claim 9 depends from claim 8 and is patentable for at least the same reasons. Accordingly, Applicants respectfully request withdrawal of the objection to claim 9.

### IV. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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